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CA 2332187 A1 2002/07/24

(21) 2 332 187

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(22) Date de dépôt/Filing Date: 2001/01/24

(41) Mise à la disp. pub./Open to Public Insp.: 2002/07/24

(51) Cl.Int.^{7}/Int.Cl.^{7} C05F 11/08

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(54) Titre : METHODE D'APPLICATION D'ENGRAIS
(54) Title: METHOD FOR COATING FERTILIZER

METHOD FOR COATING FERTILIZER

The present invention relates to a method for the treatment of soil and more particularly, it relates to a method for enhancing the properties of a fertilizer and a product produced thereby.

The use of fertilizers in agriculture is well established and indeed, as fertilizers have been credited with enabling modern society evolve from a agriculture based society to an industrial society. The art and science of the use of fertilizers is well developed and in modern large scale agriculture, fertilizers are formulated for very specific purposes.

More recently, the role of various microbes in promoting plant growth has come under investigation. It has been found that the supply of certain types of microbes to the soil can have very beneficial results in achieving increased yield and also helping to overcome some of the soil depletion which occurs as the result of the use of artificial fertilizers.

Many different types of microbes which are beneficial to the soil are known including , for example, nitrogen fixing bacteria. Nitrogen fixing bacteria can convert or fix the nitrogen directly from the air to a form of organic nitrogen to thereby provided to the plant for protein synthesis and also enriching the soil around the plants by leaving nitrogen material in the soil for later crops.

To-date, the application of fertilizer and bacteria to the soil have been considered separate operations. The application of fertilizer may be done in a dry form (most common) or by spraying in a liquid form. Similarly, the application of

bacterial to the soil has been suggested using a dry dormant bacteria or alternatively, by mixing the bacteria with an inert carrier. Spraying is also practiced.

One of the problems with the above is that ultraviolet rays can have a deleterious effect on bacteria and thus it is important that the conditions be controlled. Furthermore, the bacteria are often applied in a dormant state after undergoing a drying operation wherein a lot of cell damage occurs and the bacteria are therefore not at their most active.

It is an object of the present invention to provide a method for the delivery of bacteria to the soil.

It is a further object of the present invention to provide an enhanced fertilizer product.

It is a further object of the present invention to provide a method for treating a fertilizer product with bacteria so that they may be applied in a single step.

It is a further object of the present invention to provide a method for treating seeds with bacteria.

According to the present invention, desired bacteria, from a mother stock of the same, are subjected to a fermentation process. Typically, the bacterial fermentation process takes place where desired nutrients to permit the growth of the bacteria are supplied. In such a process, there is usually a period of dormancy of up to 2 hours following which there is a period of logarithmic reproduction until the bacterial population will generally reach an amount of approximately 10^8 to 10^{10} per millilitre.

After the fermentation has proceeded to a point where the bacterial population is in the range of 10^8 to 10^{10} per millilitre, it indicates that they are just at their full maximum potential development. At this point in time, the ferment is subject to an action to stop the fermentation. This is preferably achieved by cooling the ferment very rapidly. Preferably, the ferment is brought to a temperature of below 5 degrees C.

At this point in time, in one embodiment, the ferment is then sprayed on a fertilizer particle such that the bacteria will adhere to the fertilizer particle. The fertilizer particle, being relatively dry, will absorb the bacterial particle and the moisture will be dispersed throughout and the bacteria will remain in a latent stable state.

In a further and different aspect of the present invention, the ferment may be sprayed on a seed particle. In lieu of spraying, the ferment may also be applied by means of a binding agent such as starch or talc, or any other suitable product which would function to bind the bacteria to the seed product.

Still further, the bacterial product may be applied to the roots and/or a whole plant by spraying or other suitable means of application.

In the above process, the fertilizer may be any desired. As aforementioned, the fertilizer product absorbs the excess moisture and to this end, the fertilizer may be formulated to have this capability. Naturally, the fertilizer product will normally have a volume at least several times larger than the particle of liquid ferment. In other words, the liquid ferment is essentially atomized and sprayed onto the fertilizer

product with the moisture being absorbed over the whole of the fertilizer product and thus rendering the microbes into a latent stable state while still being relatively healthy with little cell damage. As such, they then remain stable and active and ready to resume their activity under the proper conditions of rehydration in the soil.

In one particular embodiment, the concentration of the nutritive element in the ferment may be adjusted such that there remains in the ferment, at the moment where fermentation is stopped, a certain quantity of a nutrient material. This nutritive material with the microbes will then be sprayed on the fertilizer particle. When the fertilizer particle is hydrated in the soil, the bacteria or microbe will then resume its activity and this under desirable conditions where the nutritive material is readily available. Naturally, the nutritive material is also available for use in the soil.

The particular type of bacteria or microbe which may be used with the present invention may be any known desirable type of bacteria which can successfully undergo the above treatment. Such known bacteria include nitrogen fixing bacteria, microbes used in soil bioremediation, microbes used in the dairy industry, etc.

The nutritive material in the fermentation approach can be selected from any number of known materials including different milk, animal and fish by products as well as sugars and the like.

One of the big advantages of the above process is the fact that the microbes are in a healthy state when applied to the fertilizer and have not undergone any other process which could weaken the cells such as by various other forms of drying or the like.

In one embodiment, the above process provides the possibility of utilizing a plurality of spraying steps to spray the fertilizer with the microbes. In this respect, one could use two or more different types of microbes. This possibility thus permits one to have two different fermentation processes under different fermentation conditions. Thus, as known in the art, there are different parameters for different types of microbes and one could thus run first and second fermentation processes under different conditions while spraying the fertilizer particles sequentially.

For the application, to the soil, conventional equipment may be used and thus expenses are minimized and the process is accomplished in a single operation further saving money.

As aforementioned, it is also highly advantageous that the microbes are applied to the soil in a good condition and ready to resume growth when the soil is dehydrated.

The bacterial product was applied successfully on a variety of products including rice, cucumbers, celery, soy, potatoes, evergreens, hay, corn, poinsettia plants, etc. All of the above plants exhibited better growth, more leaf, and a more developed root system.

In the invention, one preferably utilizes ferments in order to obtain fully active cultures. Such ferments are blocked by cold or other means so as to retain their full activity at the top of their growth chart. The ferments are then vaporised onto dry fertilizer particles which, depending on their respective proportions, will enable the dehydration of droplets of the ferments so that the viability and activity of the

ferments are kept intact, thus allowing them to reactivate themselves very rapidly when they are rehydrated again without having to go through all the steps of reactivation of their metabolism, the microbes having kept their almost integral activity such as at the end of their fermentation.

The fertilizer particles are a favorable environment to catch the humidity of the ferment droplets rapidly, however there are other granular or powder products available which can do the same thing. Examples are talc, sugars, flours and any other absorbent material such as commercial absorbent products capable of dehydrating ferment droplets very quickly and make it so that the final hydration of the mixture is such that the residual humidity does not allow any growth or even any metabolic activity up until the resulting product comes into contact again with sufficient humidity as to start up the metabolism again.

The applications are numerous since by choosing granular or powder absorbent products having adhesive properties, powders or particles may be enriched by concentrated ferments obtained by neutralization or concentration processes such as ultrafiltration or the like and finally mix them, for example, to fertilizers or seeds. This process may be applied to fertilizers simply by using mechanical mixers and the ferment enriched powders may be produced in a central point far from fertilizer plants. This lowers investment needs. Furthermore, each of the roots of a mix may be reproduced separately and then, after having controlled their concentration, may be mixed together with precision. This modified technology may apply to compost and any material utilized in agriculture.

It will be understood that the above described embodiment is for purposes of illustration only and that changes and modifications may be made thereto without departing from the spirit and scope of the invention.